that of the Trees it bore. That this is not a bare conjecture, may appear from the boyling up of the Water at firſt in the leſſer Hole, and its ſtanding in the bigger and lower. And if it ſhall be found that it was a very windy day whereon this accident happen'd, it will much add to the probability of this Solution.

An accident not unlike this lately happened in *Fleet-ſtreet, London*, by the defect of the arched Roof of a very deep Common-Sewer. The Earth gradually falling into the Sewer, was carried away by it, ſo as not to obſtruct the Water; and the continual tremour of the Ground, occaſioned by the conſtant paſſing of Carts and Coaches, by degrees ſhook down the Earth, ſo as to leave a very great Cavern, the Top whereof at length grew ſo very thin, that one day a weighty Cart having juſt paſt it, a great ſpace of the Pavement ſunk in, in the middle of the Street, not without hazard to a Coach then driving by.

V. *A Rectification of the Motions of the five Satellites of* Saturn; *with ſome accurate Obſervations of them, made and Communicated by the Reverend Mr.* James Pound. R.S. Soc.

IT is now above thirty Years ſince that great Aſtronomer Mr. *Caſſini* communicated to the World his diſcovery of two new Satellites of *Saturn*, which made their number Five; and the account he gave of them to the *Royal Society*, (of which he was a Member) is to be ſeen in N° 187, of theſe Tranſactions. Much about the ſame time the excellent M. *Chriſtian Huygens* of *Zulichem*, made the Society a preſent of the Glaſſes of a Teleſcope

Teleſcope of 125 Foot length, with the *Apparatus* for uſing them without a Tube; by help whereof we might have ſatisfied our ſelves of the reality of theſe Diſcoveries. But thoſe here that firſt tried to make uſe of this Glaſs, finding for want of Practice, ſome difficulties in the Management thereof, were the occaſion of its being laid aſide for ſome time. Afterwards it was deſigned for making perpendicular Obſervations of the fixt Stars paſſing by our Zenith, to try if the Parallax of the *Earths* annual Orb might not be made ſenſible in ſo great a Radius, according to what Dr. *Hook* had long ſince propoſed: but in this we miſcarried alſo, for want of a place of ſufficient height and firmneſs, whereon to fix the Object Glaſs, ſo that it lay by neglected for many Years.

In the mean time we could not but remark a great reſerve in the *French* Aſtronomers, in relation to theſe Satellites, of which they have given us in their Yearly *Memoirs* no Obſervations till very lately, nor have they ſeemed willing to ſhew them in their Glaſſes to ſuch as requeſted it: ſo that it might poſſibly occaſion in ſome Perſons a ſuſpicion of the reality of this Diſcovery: And the Reverend Mr. *William Derham* having borrowed of the Society their long Glaſs, could not thereby aſſure himſelf that the ſmall Stars he ſometimes found about *Saturn*, were really his Satellites, their ſituation not agreeing with their places derived from the Tables of their Motions exhibited in N°. 187. of *Phil. Tranſact.* beſides that he wanted a ſufficient height to raiſe the Object Glaſs, ſo as to view *Saturn* to advantage, above the Vapours of the Horizon. But in the *Memoirs* for 1714, publiſhed but about a Year ſince, M. *Caſſini*, the worthy Succeſſor of his great Father, has given us ſome Obſervations which clear up the Point, and by ſhewing the errors of thoſe firſt Tables, has enabled us to be aſſured, that we have ſeen the whole *Satellitium* of *Saturn* ourſelves.

The Subſtance of theſe Obſervations is as follows.

Anno 1714 *Maii* 6. *St. N* about Mid-night, *Saturn* being then Stationary in ♍ 4°. 27′, the Fifth and outermoſt Satellite was in its ſuperiour Conjunction with the Planet, and at the ſame time, the Earth was nearly in the Plain of this Satellit's Orbit, ſo that it appeared to paſs very near the Center of *Saturn*: From hence and from ſome other preceeding Obſervations, Mr. *Caſſini* concludes that the Nodes of this Satellit's Orb are in 4 degrees of ♍ and ♓, and that its Inclination to the Ecliptick is not much more than half that of the other Satellites. Hence it ſhould follow that the Ellipſes it deſcribes by its apparent motion about *Saturn*, when in ♊ and ♐ are much flatter and nearer to his Body, than thoſe of the other four, which he allows to move in the plain of the *Ring*, and to have their Nodes in 21^{gr} of ♍ and ♓, with an Inclination to the Ecliptick of 31 degrees. To confirm this diſcovery, he produces another Obſervation of his Fathers, near Thirty Years before, *viz.* that, *Anno* 1685, *Maii* 31. *St. N.* about Noon, the ſame Satellite was obſerved in ſuperiour conjunction with *Saturn*, with leſs than one Diameter of the Ring *North* Latitude, *Saturn* being then in ♍ 11° 48′. So that the Satellite wanted but 7°. 21′ of compleating 134 Revolutions, in the Interval of time between them. From theſe *Data* it was eaſy to ſettle the Theory of this Satellite.

As to the *Fourth* or the *Hugenian* Satellite; in the *Memoirs* for 1715, but juſt now come to hand, we find a very curious Obſervation of it, and the firſt of its kind, *viz.* that *Mart.* 25°. *S. N.* about 11^{h} *P. M.* this fourth Satellite, then in *Apogeo*, did immerge behind the Body of *turn,* With this Emendation the place of this Satellite may for the future be computed with a ſufficient exactneſs.

The Third Satellite, by an original miſtake in the Letters in N°. 187, is all wrong; its dayly Motion being there printed 2^s. 18°. 41′. 50″ inſtead of 2^s. 19°. 41′. 50″; as may be perceived by the Period thereof being determined, in the aforeſaid *Memoirs* of 1714, to be 4^d. 12^h. 25′. 12″. that is, that it makes 400 Revolutions in 1807 days. This Satellite was obſerved by Mr. *Caſſini*, *April* 4^{to}. *St. N.* 10^h. *P. M.* to have newly paſt its inferior conjunction with *Saturn*, and a perpendicular from it fell on the extremity of the weſtern *Anſe* ſo that at about 5^h. *P. M.* it was with the center of the Planet then in ♍. 5°. 23′. and conſequently in ♓ 5°. 23′. But *ineunte anno Gregoriano* 1686, the *Epoche* thereof was ♍ 9°. 39′. So that from the Noon of the laſt of *December* 1685, to *April* 4°. 6^h. 18′. *anno* 1714, that is, in 10320 Days 6^h. 18′, there have been made 2284½ Revolutions of this Satellite to the Equinoctial; from which *Data*, the Tables of its Motion are readily derivable.

The Radix of the penintime or ſecond Satellite, according to the aforeſaid Letter, *ineunte anno Greg.* 1686. was in ♍ 9°. 10′. But by the Obſervations of Mr. *Caſſini* made the Nights before and after, this Satellite was in its ſuperior Conjunction *anno* 1714. *April* 4^d 21′ ½. *St. N.* that is, in ♍ 5°. 21′, where *Saturn* then was: So that *April* 4^d. 22^h. 12′, an entire Number of Revolutions were performed ſince the *Epoche* of 1686, that is, in 10320 Days 22^h 12: which Number can be no other than 37 1, according to the Period thereof given in this *Memoire*, *viz.* 2^d. 17^h. 41′. 22″.

Laſtly the innermoſt or firſt Satellite, at the ſame time, *viz.* 1714, *April* 4°. 21^h. 30′. *St. N.* was in its inſeriour conjunction *proxime*, and conſequently in ♓ 5° 21′. But the *Epoche* thereof for 1686, is ♑. 24°. 50′. which place the Satellite had paſt 40^{gr}. 31′ at the time of the Obſervation. This Arch it moves in 5^h. 6′: Wherefore from the time of the *Epoche* to *April* 4^d. 16^h. 24′, 1714, or in 10320 Days 16^h. 24′. the Satellite has performed 5467 Revolutions, its Period being determined to be 1 Day, 21 hours, 18′. 27″, in this *Memoire*.

Having by the help of theſe late Obſervations corrected the motions of the Satellites, which it was not poſſible for their firſt Diſcoverer to ſettle truly, in the ſhort interval before 1687; and having fixed their *Epoches* for the preſent Year, we were enabled to know where to expect them with more certainty, and to diſtinguiſh them one from another, and from the ſmall fixt Stars appearing with them. And the Reverend Mr. *James Pound*, (whoſe indefatigable Induſtry is no way inferiour to his incomparable Skill in Aſtronomical matters) having, by means of his Steeple of *Wanſted*, provided a *Gnomon* high enough for the purpoſe, and having fitted a very commodious *Apparatus* for uſing the Society's aforeſaid long Teleſcope, ſoon diſcovered by it all theſe five Satellites; and lately communicated to them the following very curious Obſervations.

1718. *April* 21^d. 10^h. 40′. The third and fourth Satellits of *Saturn* were in *Apogæo*, a little paſt their Conjunction with *Saturn*: A perpendicular from the fourth to the Tranſverſe *Axis* of the Ring (or Line of the *Anſæ*) fell a little without the Eaſtern *Anſa*; and a Line through the fourth and third touched the Eaſtern Limb of *Saturn*. *Fig*. 17.

The firſt was Northward of the Line of the *Anſæ* (and therefore in the *Apogæon* Semicircle alſo) diſtant from the ſaid Line about as far as the end of the Conjugate Axis of the Ring was from the Center of ♄, *viz.*

nearly

nearly $\frac{3}{4}$ of *Saturns* Semidiameter; and it was about a Semidiameter of the Ring from the Weſtern *Anſa*.

The ſecond was a very little Southward of the Line of the *Anſæ* (and therefore in the *Perigæon* Semicircle) above a Semidiameter of the Ring (or about the Semidiameter of the Ring + the Semidiam. of ♄) from the Weſtern *Anſa*. And the Third, Firſt and Second were in a ſtrait Line.

At 10^h. 50$'$. A Perpendicular from the 3*d* to the Line of the *Anſæ* fell almoſt on the middle of the bright part of the Eaſtern *Anſa*, but ſomewhat nearer the Center than the ſaid middle.

April 22^d. 11^h. 5$'$. The four innermoſt Satellits were all Eaſtward of ♄. The 2*d* and 4*th* in the *Apogæon*, and the 1*ſt* and 3*d* in the *Perigæon* Semicircle. A Line through the 2*d* and 4*th* touched the *South-Eaſt* Limb of ♄. A Line paſſing through the 3*d* and the end of the Conjugate *Axis* of the Ring, was parallel to the Line of the *Anſæ*.

At 11^h. 10$'$ A Perpendicular from the firſt to the Line of the *Anſæ* fell on the Eaſtern Extremity of the Ring. *Fig.* 18.

Theſe Diſtances and Directions were taken only by Eſtimation, and not by any actual Meaſurement.

The fifth (or outermoſt) Satellite being at this time near its greateſt Elongation Eaſtward, among ſeveral very ſmall Teleſcopick Stars, he could not determine its Poſition. But by obſerving the Motion of this ſome other Nights before, he was now fully ſatisfied, from the Motions rectified as above, that there are five Satellits of *Saturn*, as Mr. *Caſſini* had long ſince aſſerted.

In the bright part of each *Anſa* was a darkiſh Ellipſe nearer to the out ſide than the in-ſide of the Ring, as if it was compoſed of two Rings near to one another.

On

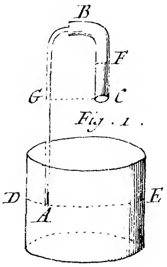
On the Body of ♄, beſide the Ring on the *South*-ſide, there appeared on the *North*-ſide a Zone not ſo far from the Center as the Ring, and not much unlike the ſmalleſt of *Jupiter*'s Belts. Theſe appearances were firſt taken notice of by Mr. *Caſſini*, as may be ſeen in *Phil. Tranſ.* N°. 128 pag 690. *Vide Fig.* 19.

We ſhall in our next give the Publick Tables of theſe Motions, corrected from the aforeſaid Obſervations, inſtead of thoſe in N°. 187. But it is not to be expected that theſe Satellites, exceedingly minute in themſelves, and ſo faintly illuminated, ſhould appear when the Air is but ordinarily Serene, they requiring not only the *Medium* to be *ſummo modo* defecate and limpid but withal in perfect Darkneſs. For which reaſons it may well be underſtood why the Gentlemen of the *Pariſian* Obſervatory may have ſometimes made a difficulty to undertake to ſhew them upon demand.

FINIS.

Printed for W. and J. Innys, Printers to the *Royal Society*, at the *Princes-Arms* in St *Paul*'s Church-Yard, the corner of *Ludgate-ſtreet.* 1718.

Philoſoph. Tranſact. No. 355.



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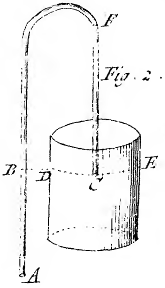

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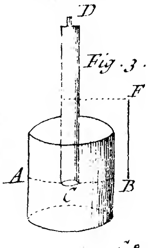

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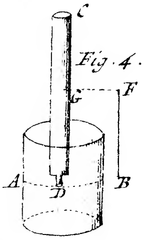

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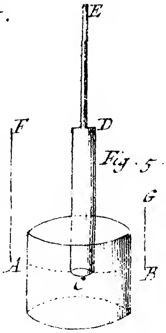

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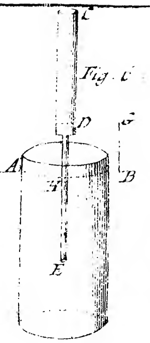

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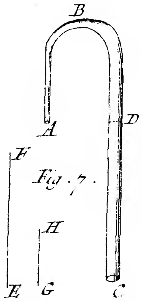

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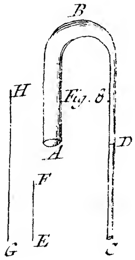

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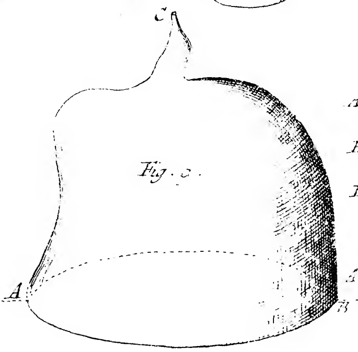

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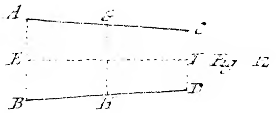

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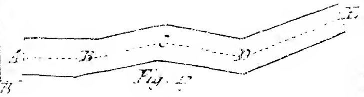

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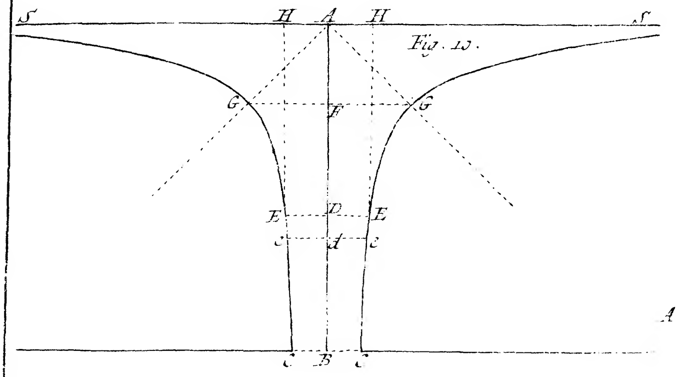

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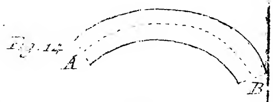

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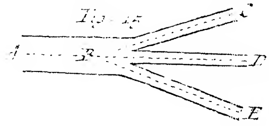

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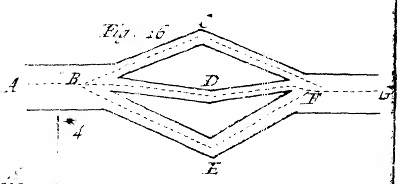

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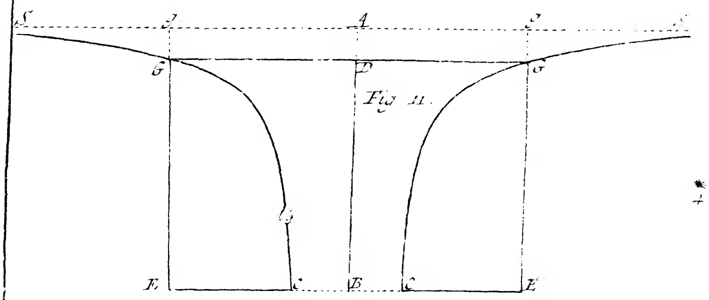

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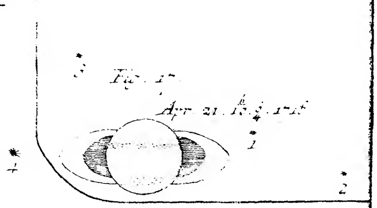
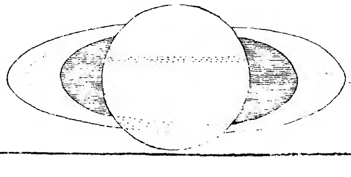


Fig. 17.

Apr. 21. 10h. ½. 1718



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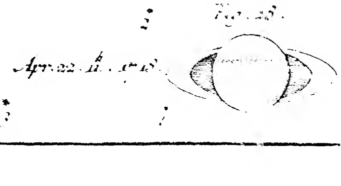

Fig. 18.

Apr. 22. 11h. 1718.